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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/518,709	03/03/2000	Takahisa Yamaha	P/2171-180	5749

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EXAMINER

ORTIZ, EDGARDO

ART UNIT

PAPER NUMBER

2815

DATE MAILED: 03/27/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.  
09/518,709

Applicant(s)  
Yamaha

Examiner  
Edgardo Ortiz

Art Unit  
2815



-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on Dec 23, 2002.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 14-28 is/are pending in the application.
- 4a) Of the above, claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 14-28 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claims \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some\* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\*See the attached detailed Office action for a list of the certified copies not received.

- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). \_\_\_\_\_ 6) ☐ Other:

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### **DETAILED ACTION**

This Office Action is in response to an amendment filed December 23, 2002 on which Applicant amended claims 14 and 19.

#### ***Claim Rejections - 35 USC § 112***

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim 14, and its dependent claims, are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for a hydrogen transmission preventing film, does not reasonably provide enablement for a hydrogen transmission preventing film that is a silicon oxide film that contains a SI-H residue of 61% or less. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to use the invention commensurate in scope with these claims. The specification, on page 18, lines 1-24, describes the hydrogen transmission preventing film as consisting of silicon nitride and does not disclose the film as a silicon oxide film that contains a SI-H residue of 61% or less.

#### ***Claim Rejections - 35 USC § 103***

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are

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such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 14, 16 and 21 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Jung (U.S. Patent No. 5,674,759). As best the examiner is able to ascertain the claimed invention, with regard to claim 14, Jung teaches a semiconductor substrate (1), a MOS type transistor formed on said semiconductor substrate, said MOS transistor including a source (3), a gate (7) and a drain (4), an interlayer insulating film (11) formed on the semiconductor substrate, said interlayer insulating film covering said MOS transistor and including a hydrogen resident film, a wiring layer (8, 9) formed on said interlayer insulating film and a hydrogen transmission preventing film (12) covering the MOS transistor and said wiring layer, that contains a nitride (SiN:H) and has a low hydrogen diffusion coefficient and reduces the out diffusion of hydrogen, thereby producing a low Si:H residue. The claimed percentage of Si-H residue can be modified by known processes such as heat treatment in order to obtain the desired percentage.

With regard to Claim 16, Jung teaches a hydrogen transmission preventing film (12) that includes silicon nitride (SiN:H).

With regard to Claim 21, Jung teaches a hydrogen supply path for supplying the channel region (5) of the MOS transistor that is formed between the channel region and the hydrogen resident film (11), see figure 2.

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Claim 15 is rejected under 35 U.S.C. 103 (a) as being unpatentable over Jung (U.S. Patent No. 5,674,759) in view of Inoue (U.S. Patent No. 5,976,966). With regard to Claim 15, Jung essentially discloses the claimed invention but fails to show, the hydrogen resident film containing hydrogen silsesquioxane resin. Inoue teaches a hydrogen resident film that contains hydrogen silsesquioxane resin  $(\text{HsiO}_3/2)_n$ . Therefore, it would have been an obvious modification to someone with ordinary skill in the art, at the time of the invention, to modify the structure as taught by Jung to include a hydrogen resident film containing hydrogen silsesquioxane resin, as clearly suggested by Inoue, in order to provide a film with known abundance of hydrogen in its structure.

Claims 17 and 18 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Jung (U.S. Patent No. 5,674,759) in view of Takahisa et.al. (Japanese Patent No. 08-222633). With regard to Claims 17 and 18, Jung essentially discloses the claimed invention but fails to show, a wiring layer having a lamination structure of Ti/Al alloy/TiN or Ti/Al-Si-Cy alloy/TiN. Takahisa teaches a wiring layer (19) having a lamination structure of Ti/Al alloy/TiN or Ti/Al-Si-Cu/TiN.

Therefore, it would have been an obvious modification to someone with ordinary skill in the art, at the time of the invention, to modify the structure as taught by Jung to include a wiring layer having a lamination structure of Ti/Al alloy/TiN or Ti/Al-Si-Cy alloy/TiN, as clearly suggested by Takahisa, in order to prevent hot carrier deterioration due to moisture and reduce interface state density.

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Claim 19 is rejected under 35 U.S.C. 103 (a) as being unpatentable over Jung (U.S. Patent No. 5,674,759) in view of Applicant's admitted prior art as shown on figure 6 and its description on page 4, lines 10-15. Jung teaches a semiconductor substrate (1), a MOS type transistor formed on said semiconductor substrate, said MOS transistor including a source (3), a gate (7) and a drain (4), an interlayer insulating film (11) formed on the semiconductor substrate, said interlayer insulating film covering said MOS transistor and including a hydrogen resident film, a wiring layer (8, 9) formed on said interlayer insulating film and a hydrogen transmission preventing film (12) covering the MOS transistor and said wiring layer.

However, Jung fails to teach that the hydrogen transmission preventing film forms an air filled groove between adjacent wiring layers. Applicant's admitted prior art teaches a silicon nitride layer (3) that forms a groove (GV) which is filled with air having a dielectric constant of 1. Therefore, it would have been an obvious modification to someone with ordinary skill in the art, at the time of the invention, to modify the structure as taught by Jung to include a hydrogen transmission preventing film forms an air filled groove between adjacent wiring layers, as clearly suggested by Applicant's admitted prior art, in order to reduce wiring capacitance.

Claim 20 is rejected under 35 U.S.C. 103 (a) as being unpatentable over Jung (U.S. Patent No. 5,674,759) in view of Applicant's admitted prior art as shown on figure 6 and its description on page 4, lines 10-15 and further in view of Bai et.al. (U.S. Patent No. 5,861,340). Jung and

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Applicant's admitted prior art essentially disclose the claimed invention but fail to show, silicide layers formed on the silicon gate electrode and the source/drain regions. Bai teaches a semiconductor device including a MOS transistor having a silicon gate electrode (204), source/drain regions (216) and silicide layers (220) on the silicon gate electrode and the source/drain regions. Therefore, it would have been an obvious modification to someone with ordinary skill in the art, at the time of the invention, to modify the structure as taught by Jung and Applicant's admitted prior art to include silicide layers formed on the silicon gate electrode and the source/drain regions, as clearly suggested by Bai, in order to decrease the resistance of the gate electrode.

Claims 22, 24, 27 and 28 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Jung (U.S. Patent No. 5,674,759) in view of Bai et.al. (U.S. Patent No. 5,861,340). Jung teaches a semiconductor substrate (1), a MOS transistor having a gate insulating film (6), a silicon gate electrode (7) formed on the gate insulating film, source/drain regions (3, 4), formed on the silicon substrate on both sides of the silicon gate electrode, an interlayer insulating film (11) formed on the semiconductor substrate, covering said MOS transistor and including a hydrogen containing film, a wiring layer (8, 9) formed on said interlayer insulating film and a hydrogen shielding layer (12) formed on the interlayer insulating film, covering the MOS transistor and the wiring layer.

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However, Jung fails to teach silicide layers formed on the silicon gate and source/drain regions. Bai teaches a semiconductor device including a MOS transistor having a silicon gate electrode (204), source/drain regions (216) and silicide layers (220) on the silicon gate electrode and the source/drain regions. Therefore, it would have been an obvious modification to someone with ordinary skill in the art, at the time of the invention, to modify the structure as taught by Jung to include silicide layers formed on the silicon gate electrode and the source/drain regions, as clearly suggested by Bai, in order to decrease the resistance of the gate electrode.

With regard to Claim 24, Jung teaches a hydrogen shielding layer (12) that includes silicon nitride (SiN:H).

With regard to Claim 27, Jung teaches a wiring layer that includes a plurality (8, 9) of wiring patterns and the hydrogen shielding layer (12) forms recessed surfaces between adjacent ones of the wiring patterns, see figure 2.

With regard to Claim 28, Jung teaches an interlayer insulating film (11) that constitutes a hydrogen supply path between the hydrogen-containing film and the silicon substrate (1) under the gate insulating film (6).



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Claims 25 and 26 are rejected under 35 U.S.C. § 103 (a) as being unpatentable over Jung (U.S. Patent No. 5,674,759) in view of Bai et.al. (U.S. Patent No. 5,861,340) and further in view of Takahisa et.al. (Japanese Patent No. 08-222633). Jung and Bai essentially disclose the claimed invention but fails to show, a wiring layer having a lamination structure of Ti/Al alloy/TiN or Ti/Al-Si-Cy alloy/TiN. Takahisa teaches a wiring layer (19) having a lamination structure of Ti/Al alloy/TiN or Ti/Al-Si-Cu/TiN. Therefore, it would have been an obvious modification to someone with ordinary skill in the art, at the time of the invention, to modify the structure as taught by Jung and Bai to include a wiring layer having a lamination structure of Ti/Al alloy/TiN or Ti/Al-Si-Cy alloy/TiN, as clearly suggested by Takahisa, in order to prevent hot carrier deterioration due to moisture and reduce interface state density.

### *Response to Arguments*

3. Applicant's arguments with respect to claims 14-28 have been considered but are moot in view of the new ground(s) of rejection.

### *Conclusion*

4. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

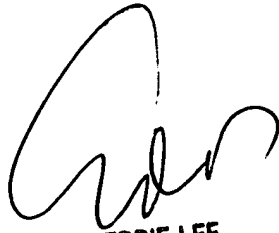
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A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Edgardo Ortiz (Art Unit 2815), whose telephone number is (703) 308-6183 or by fax at (703) 308-7724. In case the Examiner can not be reached by a direct telephone call, you might call Supervisor Eddie Lee at (703) 308-1690. Any inquiry of a general nature or relating to the status of this application should be directed to the Group 2800 receptionist whose telephone number is (703) 308-0956.

EO / AU 2815

3/21/03



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